SECOND SERIES VOL. VII, No. 10

# BULLETIN

OF

# THE NEW YORK ACADEMY OF MEDICINE

OCTOBER, 1931

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# EDITORIAL

## AN OUTLINE OF THE HISTORY OF THE CIRCULATORY SYSTEM[1]

The development of our knowledge of the circulatory system, its anatomy, physiology, pathology and surgery, is perhaps the most momentous and consequential episode in the general development of medicine. For the function of the circulation begins where those of digestion and metabolism leave off and ends at that vague borderland in the tissues where its business is taken over by respiration. Nothing worthwhile was, or could be known about the circulation until its true structural basis had been ascertained. Further progress was then actually obscured by anatomical reasoning (*anatomia animata*), for true physiological reasoning about the motion of the blood and its consequences had to wait upon the factor which Sarton signalizes as most decisive in the making of recent science, namely instrumentation. Harvey's ligations and meas-

[1]In preparing this review, the writer is indebted principally to the idiomatic translation of Harvey's *De motu cordis* by Professor Chauncey D. Leake (Baltimore, C. C. Thomas, 1931), with his scholarly annotations; to the treatise on *Diseases of the Heart and Aorta* by G. A. Gibson (Edinburgh, 1908), which contains the first thoroughgoing bibliographic investigation of the history of circulatory disorders; and to the very exhaustive and handy arrangement of essential data in Sir Humphry Rolleston's Harveian Oration (Cambridge, 1928). The chapter on the circulation in Dr. Stephen d'Irsay's unpublished *History of Physiology*, which I have had the pleasure of reading, contains an ingenious discussion of mooted points and borderline problems, some of which are beyond the scope of the present article. His work is creditable to the Leipzig Institute.

urements, Malpighi's microscope, Hales's blood-pressure tube, Ludwig's kymograph, Marey's sphygmograph, the Einthoven string galvanometer, did more to enlighten us than nineteen centuries of guess-work and footless speculation, from Erasistratus to Cesalpinus. The watch, the stethoscope and the tonometer established the modern approach to a scientific diagnosis of disorders of the circulation. The ligation of arteries, from Celsus to Carrel, was the most going principle in operative surgery, apart from such comparatively recent innovations as anæsthesia, antisepsis and the abolition of shock.

Two observations of prehistoric man go to show the importance attached to the heart and the blood from the earliest times. Mural paintings of bison and mammoth in prehistoric caverns sometimes indicate the position of the heart by an appropriate figure or cross-mark, as a sort of memorandum for the huntsman, betokening, Singer thinks, an "anatomical instinct," like that displayed by the ichneumon fly in administering the *coup de grâce* to other insects. It is certain, also, that the fading out of life in hæmorrhage from a fatal wound left its mark upon the primitive mind. The flowing blood became associated with the idea of being alive, as evidenced by the words employed in the ancient Teutonic spells for hæmostasis (Sudhoff). The ancient Assyrians also knew that pressure on the carotid arteries abolishes consciousness. And here, at once, we have the starting point of the humoral pathology and of prehistoric surgery. What Sudhoff calls huntsman's and butcher's anatomy of the heart in animals was further advanced by "sacrificial anatomy," the knowledge gained from viewing the pulsating heart thrown down before the altar. This purview of the autonomous, extravital heart-beat was, in some respects, the best hint the ancients had, but they were in no position to draw inferences from it. The pseudo-Hippocratic tract *De corde* (400 B. C.) already views the heart as a muscle. Dissection of animals brought out its relation to the vascular system, the crude diagrammatic schema of the veins and

arteries known to Aristotle and the Alexandrians (Five Picture Series), while venesection and battle-wounds led to inferences from the oozing and spurting of blood. The sanguine appearance and weight of the liver, already noted by Empedocles (Fr. 150) as *polyhaematon hepar,* led Aristotle to the unlucky inference that it makes blood, hence must be the starting point of the circulation. From the fact that the arteries are relatively empty at death, Praxagoras, Herophilus and Erasistratus inferred that they contain air (*pneuma*). Herophilus (300 B. C.) timed the pulse with a water-clock and originated the complex pulse-lore (*ars sphygmica*), taken over by Galen and current up to the Napoleonic period. Erasistratus named the tricuspid and sigmoid (semilunar) valves, noted the chordæ tendineæ, inferred the existence of adjacent mouths (*synanastomoses*) at the terminals of the ultimate ramifications of the arteries and veins, and even noted a wave-like progression of the pulse, subsequently denied by Galen. From the old Ionian notion that all things are in a state of flux (*panta rhei*) and that cosmic and organic processes move in cycles or circles (Heraclitus), it was not difficult for Erasistratus to infer some sort of dual circulation which, however, he described backwards: from the liver to the heart by the arteries, from the heart to the lungs by the veins, with liver and heart as primary and secondary source-pumps, implying two periodic oscillations. By arteriotomy in living animals, Galen demonstrated that the arteries contain not air, but blood. From the simple observation that the blood pulsates between the heart and a ligated artery, Galen demonstrated the motor power of the heart and confirmed its extra-vital autonomy in the excised hearts of sacrificial animals. Galen's scheme of the circulation took over the duplex motor (heart-liver) system of Erasistratus, but inferred a centrifugal motion of the blood from the heart *viâ* the arteries and from the liver *viâ* the veins, with a consequent shuttle-wise ebb and flow through the two channels[2], the only means of communication between

[2]This idea may have gained currency from Aristotle's perplexity over the violent flux and reflux of the tide of the Euripus, which Leake describes

the two circulations being certain imaginary pores in the interventricular septum[3]. Into all this, Galen injected the mysticism associated with the idea of the *pneuma*. The arterial blood acquires vital spirits from the right ventricle, the venous blood natural spirits from the liver and both are converted into animal spirits in the brain. Over and above this complex scheme stood Aristotle's notion of the primacy of the heart as the "Acropolis of the body,"[4] indeed the actual organ of thought and origin of the nerves, an inference derived from the fact that he mistook the linear fibres in the ventricles of larger animals for nerves emanating from the heart.

For nearly fourteen centuries, this Galenic scheme of the circulation, with its well-imagined permeable septum, its twin motors, its duplex centrifugal currents, its intervention of vital, natural and animal spirits, its view of the lungs and the brain as cooling plants, held its own, along with the Aristotelian notion that the heart is the locus of thought. The chronologic arrangement of usages of the word "heart" in Murray's English Dictionary affords an astonishing perspective of the persistency of our ancestors' belief that the heart thinks. In spite of the phrenological diagrams of the Middle Ages and the superstitions about animal spirits, the fact that the brain does the thinking (Alcmæon, Pythagoras) was not definitely settled until the time of Flourens. After Harvey's time, the locus of thinking was transferred from the heart to the blood, which apparently goes back to Empedocles (Fr. 105):

> "In the blood-streams, back-leaping unto it,
> The heart is nourished, where prevails the power
> That men call thought; for lo the blood that stirs
> About the heart is man's controlling thought."

What happened between Galen's time and Harvey's?

[3]Probably an inference from the actual Thebesian veins (Leake), or the patency of the foramen ovale in certain adult animals (d'Irsay).

[4]Aristotle: *De partibus animalium*, III. Cited by d'Irsay.

as "A narrow channel 113 miles long between Euboea and Boeotia, opposite Chalcis." (foot-note I to *De motu cordis*, Ch. I.). Galen (*De usu partium*, VI, 10) says that without the veins, the blood would "tide-like, as the Euripus, flow back and forth in a way not suited to it."

At least thirteen centuries of facile acceptance of Galenic dogma, with an additional century or more of speculation, set off by a number of lucky inferences and a solitary ligation experiment by Cesalpinus. The high spots were Leonardo's delineations of the valves of the heart[5] and the moderator band and his demonstration of the cardiac impulse by needling (Iliad), all which remained buried for centuries; the discovery of the valves in the veins by Canano and Estienne (1551) and their delineation by Fabricius ab Aquapendente (1574); the discovery of blood in the pulmonary veins by Servetus, with his denial of the permeability of the septum hence the first correct account of the pulmonary circulation (1553); and the two capital discoveries of Cesalpinus, that the vena cava does not originate from the liver and that the flow of blood in the veins is centripetal (1571), with his subsequent experimental proof of this fact, from the swelling of a vein below the ligation (1593). Vesalius describes the left auriculo-ventricular valves of the heart as "mitral," and while playfully accepting the dogma of a permeable septum in his first edition (1543), adopts the correct view of Servetus (1553) in the second edition of the *Fabrica* (1555). Cesalpinus confirms Servetus's view of the pulmonary circulation, describes the flow of blood, from the right ventricle through the pulmonary artery to the lungs and its ultimate return to the left ventricle, as a *sanguinis circulatio;* grasps the function of the cardiac valves and calls the terminal twigs of the blood-vessels *capillamenta;* obliterates the liver as a source-pump of blood and first establishes the flow of venous blood toward the heart. But in lieu of capillary anastomosis, he conceives of a kind of attraction (*auctio*) of blood between the arterial and venous terminals, fails to perceive the ultimate identity of arterial and venous blood, and so conceives of a circulation with a solution of continuity at the *"osculi communicantes"* (the old Galenic *synanastomoses*). Nevertheless, the main facts about the circulation were more

[5]Leonardo called the cardiac valves "portals" (*porte*) or "outlets" (*uscioli*). D'Irsay, footnote 11.

or less in the air, as matters of speculation, when Harvey began his work. Long before Cesalpinus and Columbus, certain Spanish anatomists, Lobera de Avila (1542), Plata (1545), Monserrate (1551), had tried to improve upon the old Galenic framework and one of these, a veterinarian, Francisco de la Reina, adumbrated the circulation (1552), some 20-43 years before Cesalpinus.

What then did Harvey accomplish? To open the *De motu cordis* is to enter the laboratory of the ablest investigator of comparative anatomy and physiology since Aristotle and Galen. To read it is like reading Beaumont's book of experiments on gastric digestion. Everywhere, we are conscious that Harvey wishes to abandon speculation and actually tries to make us see how the heart works, how the blood flows in vivisected animals, even as Beaumont visualizes the interior of the stomach *in situ* through his accidental experiment in physiological surgery. Applying his plain, practical common sense to Galen's postulates, Harvey proceeds, step by step, to demonstrate every point he makes by actual vivisection and experiment. In his Introduction, he makes a clean sweep of the errors of the ancients. Next he analyses the mechanism of events in the cardiac cycle and demonstrates that the heart is not a suction pump but a force pump, the ventricles being filled by auricular contraction (Ch. III); next he considers the effect of the pumping action on the arteries (III); next the rôle of the auricular contraction in the production of heart-beat, heart-block, and venous pressure, and the longevity of the right auricle at death (IV). Then the mechanisms of auriculo-ventricular rhythm and of the heart sounds (V); then the comparative anatomy and physiology of the blood-flow into, through and out of the heart (VI-VII); next the proof of the circulation of the blood by a quantitative demonstration, viz., that, within brief time-units, the heart will pump out blood in excess of what can be fabricated from the food or of what is needed by the system or of the total volume of blood in the body or even of the total weight of the body (VIII-

IX); finally the proof of the major circulation and of the necessity for capillary anastomosis, or its equivalent, by innumerable vivisections and ligation experiments (X-XIII). Chapter XIV states the conclusion of the whole matter. Chapter XV is philosophical and speculative. Chapter XVI considers the application of the new doctrine to the practice of medicine. Chapter XVII deals with the comparative physiology of the circulation in man and animals. The terminal sentence of Chapter IX announces a consideration of "the place, manner and purpose of arterio-venous anastomosis," but the *salto mortale* is never taken, and in Chapter XI, Harvey concludes "that there is either an anastomosis of these vessels or pores in the flesh and solid parts permeable to blood." The supreme finishing touch had to wait upon Malpighi's microscope (*De pulmonibus,* 1661). As Fraser Harris observes, Harvey's demonstration made capillary anastomosis a logical necessity; Malpighi made it a histological certainty.

Harvey's demonstration, then, takes us into an entirely different atmosphere from the closet and studio speculations of his Spanish and Italian precursors. We are in the full current of essentially modern laboratory experimentation, with no whirligig proofs, but extraordinary leaps forward into the medicine of the future. Harvey was the first to elucidate the apex-beat (II), the possibility of "fibres spirally arranged" (II, MacCallum and Mall); the mechanism of the heart-beat, and of physiological heart-block, venous blood-pressure[6], resuscitation of a stopped heart by a perfusion experiment[7] (IV); the

[6]"When the auricles contract, they become pale, especially when they hold little blood, for they are filled as reservoirs, the blood freely pressing toward them by the compressing motion of the veins. *De motu cordis,* IV. Cited by Leake.

[7]"In an experiment one time on a pigeon, after the heart had stopped, and even after the auricles were motionless for some time, I placed my finger, warm and wet with saliva, upon the heart. By this warm application, it recovered life and strength. The auricles and ventricles beat, alternately contracting and relaxing, as if recalled from death." *Op. cit.,* IV.

pulse as an expression of the pumping action of the heart, the heart sounds as a species of intra-thoracic pulse (V), the possibility of "vascular openings" (anastomoses) through the lungs (VII); the ultimate excess of stroke-volume output over total volume of blood (VIII-IX); the effect of physiologic, dietetic and psychic factors upon cardiac output and velocity of the blood-current[8] (IX); and the relation of the pumping action of the heart to virtual arterial blood-pressure (XI, XII, XVII). Leake even notes some vague hints of the lacteals ("milky vessels," XIII), cutaneous absorption of drugs (XVI), valvular incompetence[9] (XVII), vaso-constriction and vaso-dilatation[10] (XVII), and d'Irsay some glimpsing of auricular fibrillation[11] (IV). Harvey even boiled a heart to get at the ultimate arrangement of its fibres (XVII). Some of his experiments have been visualized by Lewis and Dale in the Harvey Film. His main errors were to hug the old superstition about the cooling function of the lungs and to attribute the heart-beat to "innate heat," which Sir Clifford Allbutt identified with oxygen. Again, Harvey ignores Copernicus and Kepler when he likens the circular motion of the blood to the old Ptolemaic notion

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[8]Recently confirmed by A. Grollman in *Am. J. Physiol,* 1929-30, LXXXVIII-XCIV, *passim.* Cited by Leake.

[9]"They are not present in all animals, for the reason stated, nor do they seem to have been made with the same efficiency in those in which they are found. In some they are made to fit exactly, in others poorly and negligently, so that they may be closed according to the greater or lesser impulse from the contraction of the ventricles." *Op. cit.,* XVII. Noted by Leake.

[10]"So the terminal arteries appear like veins, not only in structure, but also in function, for they rarely show a perceptible pulse unless the heart beats more violently, or the arteriole dilates or is more open at the particular point." XVII.

[11]"Besides this, I have sometimes noticed, after the heart and even the right auricle had completely stopped beating, that a slight motion or palpitation remained in the blood in the right auricle, as long as it seemed imbued with heat and spirit." IV. At this point (see *supra*), Harvey transfers the old Aristotelian primacy of the heart to the blood, and apparently by mistaking virtual auricular fibrillation for "palpitation of the blood."

of "the circular motion of the stars." (VIII). Harvey's literary manner is sometimes diffuse but never obscure. As Leake surmises, some of his chapters were evidently assembled hastily from rough notes, and the promised chapter on the inter-ventricular septum, the tracts on respiration, on the spleen, on practice of medicine, were never written, or else destroyed by the Roundhead troopers, who invaded Harvey's chambers at Whitehall in 1642.

The height of Harvey's great argument, then, is the first employment of measurement in any biological investigation of magnitude. Galen had pointed out, what any butcher knows, that the whole volume of blood (V) in an animal body can be drained out in less than 15-30 minutes. If the discrete stroke-volume quantum of the cardiac output in unit time be Q, then for total quanta in increasing time intervals ($t_1$, $t_2$, $t_3$ . . .), Harvey shows that $V < Qt_1 < Qt_3 < Qt_2 \ldots < Qt_n$.[12] This little excursus into mathematical physics puts him miles and marine leagues ahead of his competitors, as a practical, common-sense investigator, thinking in advance of his time.

Harvey's *opus magnum*, printed at Frankfurt on the Main, the great center of the continental book trade, exerted a profound influence upon the physiologists of his time. The fact that it caused a distinct falling off in his bedside practice is negligible. He was but an indifferent practitioner. But it is known that he contemplated the publication of his own clinical observations on "the innumerable diseases concerned with disorders of the circulation and their cure," and, in fact, cites some of these in Chapters III, XI and XVI of the *De motu cordis*. But little was known about diseases of the heart and disorders of the circulation before the 18th century. The Hippocratic Canon contains the first mention of auscultation (friction sound and succussion in pleurisy). Herophilus counted and analyzed the pulse, Galen distinguished between traumatic and spontaneous aneurism, for which Antyllus devised the treatment by ligations which goes by his name, but

[12] *nobis.*

of heart disease the Greeks knew nothing. The *morbus cardiacus* of the ancients (Celsus, III, 19) was a condition of extreme debility, with small, weak pulse, gastric atony and colliquative perspiration, obviously not of cardiac origin. The pseudo-Hippocratic *De corde* regarded heart disease as non-existent (*cor aegrotare non posse*). The therapeutic use of the heart of small animals was a superstition attaching to the chthonian neuropathology, but it was never applied to heart disease, the existence of which continued to be denied or ignored well nigh unto the end of the 17th century. The diagnosis between aneurisms of the thoracic and the abdominal aorta by Vesalius (1557) was perhaps the most outstanding pathological observation between Galen and Vieussens. Fernelius made post-mortems of internal aneurisms and was the first to associate the condition with syphilis (1542). Paré attributed aneurism to the use of mercurials (1582). Nicholas Massa is said to have noted cardiac (myocardial) hypertrophy. Aortic stenosis was first observed by Riverius (1646) and mitral stenosis by the physiologist John Mayow (1669), possibly also by Harvey. Bonet, in his *Sepulchretum* (1679), noted cardiac "polypi" with palpitation and precordial pain, pericardial adhesions and effusions, myocardial calculi and inflammation. But real knowledge of heart disease, particularly of valvular lesions begins with Vieussens (1715), Albertini (1721), Lancisi (1728), Senac (1749) and Morgagni (1761).[13] Vieussens, who was the first to correlate the semeiology of heart disease with the pathological lesions, noted a case of absence of the pericardium in a double heart (1672), two cases of pericardial dropsy (1673), which led him to the correct diagnosis of a third case (1675), subsequently confirmed by post-mortem (1676), and left two masterly delineations of the symptoms and pathological appearances of aortic stenosis (1695) and mitral stenosis (1715), with a notation of the character-

[13]For a detailed account of these contributions to cardiac pathology, see P. J. Philipp: *Die Kenntnis von den Krankheiten des Herzens im achtzehnten Jahrhundert,* Berlin, 1856.

istic "jerking pulse" of aortic stenosis, subsequently associated with the name of James Hope (1839). Vieussens' treatise on the heart (1715)[14] is the most important contribution to the subject in the 18th century. Lancisi's monographs on sudden death (1707)[15] and aneurism (1728)[16] are the classical contributions on so-called cardiac aneurism,[17] stressing its fatality, its multiplex ætiology (heredity, mechanical obstructions, emotional depression, over-exertion, alcohol, syphilis), the irregularity and inequality of the pulse and the exaggerated cervical venous pulse. Albertini, a pupil of Malpighi and a teacher of Morgagni, devoted himself to organic heart diseases (1726)[18], in particular cardiac dilatation and hypertrophy. He pointed out that the right side of the heart is most liable to dilatation, the left to hypertrophy, introduced palpation in the diagnosis, and, following Valsalva, who treated aneurism by a 40-day rest and starvation cure (with preliminary venesection) and applied this method to cardiac hypertrophy and dilatation with considerable success. Morgagni's *consilia* on diseases of the heart are found in the second book of his *De sedibus* (1761). With Auenbrugger, whose classic on percussion was published in the same year, Morgagni was the first to stress the importance of physical signs in the diagnosis of diseases of the chest. He made the first clinical notation of Stokes-Adams disease, revised the semeiology of pericardial dropsy, made a clear differentiation of cardiac hypertrophy and dilatation, added considerably to the semeiology of valvular diseases, associated cyanosis with or-

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[14]Vieussens: *Traité nouveau de la structure et des causes du mouvement natural du cœur.* Toulouse, 1715.

[15]Lancisi: *De subitaneis mortibus, libri duo.* Rome, 1707.

[16]Lancisi: *De motu cordis et aneurysmatibus.* Naples, 1728.

[17]By cardiac aneurism, these writers usually meant general enlargement of the cardiac cavities (hypertrophy or dilatation). Real cardiac aneurism was first seen by Galeati (1751) and later by John Hunter and Matthew Baillier (Rolleston).

[18]Albertini: *Animadversiones super quibusdam difficilis respirationis vitiis a laese cordis et praecordiorum structura pendentibus.* Bologna, 1726.

ganic heart disease, elucidated the venous pulse and showed the effect of disease of the right heart upon pulmonary stasis and hæmoptysis and of pulmonary catarrh upon organic heart diseases. Senac wrote the first definitive treatise on heart diseases (1749)[19], a book which attained its second edition 34 years later (1783) and which won the highest commendation from Morgagni and Haller. Senac first stressed the importance of pericarditis and its diagnosis, noted eccentric hypertrophy of the cardiac walls as a sign of cardiac "aneurism," elucidated cardiac "polypi" as post-mortem artefacto, emphasized the tendency to heart disease in the aged, the small flaccid heart of consumptives, and brought out several important points in the diagnosis of valvular insufficiencies and stenoses. All in all, this group of 18th century clinical pathologists achieved one of the most brilliant chapters in the science of disorders of the circulation.

In the year in which the *De motu cordis* was published, Malpighi, the founder of histology was born (1628). With the aid of the microscope, Malpighi added the coping stone to Harvey's demonstration by his discovery of continuous circulation of the blood through the capillary anastomoses in the frog's lung (*De pulmonibus,* 1661). At the same time, he saw the rouleaux of red blood corpuscles in the mesentery of the hedgehog, but mistook them for fat cells. These discoveries were confirmed by Leeuwenhoek in his *True Circulation of the Blood* (1668). That the erythrocytes are common to arterial and venous blood was a further confirmation of the circulation. That the real and only difference between arterial and venous blood is chemical was surmised by Harvey in his Introduction and ascertained by John Mayow (1668). Swammerdam saw and understood the erythrocytes as early as 1658, but his findings were not known until Boerhaave published the *Biblia naturae* in 1738. These discoveries are the vague beginnings of hæmatology, which really took its start with the cell-theory of Schleiden and Schwann

[19]Senac: *De la structure, de l'action et des maladies du cœur.* Paris, 1749.

(1838-9) and its application to pathology by Virchow (1845-58). Early landmarks were the notations of chlorosis (*morbus virgineus*) by Johann Lange (1554) and Friedrich Hoffman (1731), the initial account of purpura hæmorrhagica by Werlhof (1735), the introduction of human inoculation of small-pox by Timoni, Pylarini and Lady Mary Wortley Montague (1721) and of vaccination by Jenner (1798), the inoculation experiments of Stephen Weszkremi (plague, 1755) and Francis Home (measles, 1759), John Hunter's auto-inoculation of syphilis (1786) and his treatise on the blood (1794). There arose the conviction that the blood is "a most peculiar juice" (Goethe, *Faust*), at once the locus of inflammation, of infection and transmission of syphilis, small-pox and other communicable diseases. William Hewson's "Experimental Inquiry" of 1771 was the starting point of a long line of first class investigations on the coagulation of the blood, notably those of Andrew Buchanan (1845), Alexander Schmidt (1861), Lister (1862), Hammarsten (fibrinogen, 1875) and W. H. Howell (1910-30). Leukæmia was described simultaneously by Virchow and John Hughes Bennett in 1845. Virchow, in fact, created the science of the leucocytes and of the pathological significance of embolism and thrombosis (1846-56). Knowledge of the third formed element of the blood, the platelets or thrombocytes, was developed by Alexander Donné (1842), Osler (1873) and Bizzozero (1883). Lagrange's findings on the oxygenation of the blood (Hassenfratz, 1791) were furthered by the discovery of hæmoglobin (Hoppe-Seyler, 1862-4) and were expanded to the general concept of tissue-respiration by the researches of Gustav Magnus (1837), Lothar Meyer (1857-8) and Pflüger (1866-8) on the gasometry of the blood. Endocrinology was foreshadowed in Théophile de Bordeu's treatise on the blood (1776) and began with Addison's descriptions of pernicious anæmia and suprarenal disease (1849-53) and Claude Bernard's experiments on glycogen (1848), pancreatic juice (1849) and fourth ventricle diabetes (1849).

Anaphylaxis (Bordet, 1901) had been noticed by Jenner (1798) and Magendie (1837) and John Hunter (1794) had stumbled upon the bactericidal power of blood-serum (Buchner, 1889). Serotherapy (Roux, 1889, Behring, 1893), bacteriolysis (Pfeiffer, 1894), hæmolysis (Bordet, 1898), serodiagnosis (Wassermann, 1907), were necessary consequences of the development of bacteriology and revived the humoral pathology. Phagocytosis was discovered by Metchnikoff (1892-5), who, in 1892, also adumbrated the reticular-endothelial system (Aschoff, Maximow). The science of the anæmias was developed by Ehrlich and Lazarus (1898). The hæmolytic effect of serpent venoms was investigated by Weir Mitchell and Reichert (1870-86), Flexner and Noguchi (1901-9) and the serotherapy of snake-bite by Fraser (1896) and Calmette (1896). All these developments of hæmatology, including those concerned with the transmission of infection by blood-channels, were consequent upon Harvey's conclusive experiments upon the circulation.

The most important contributions to the gross anatomy of the heart were probably the drawings of Leonardo da Vinci, which remained buried for centuries and were too far in advance of their time to be appreciated until latterly. Leonardo drew the valves of the heart, unrolled, in a kind of Mercator's projection, noted the moderator band and some features of the functional system, and was even a precursor of the cross-sectional anatomy of Pirogoff (1852-9), whose pictures of the heart and its tunic, sliced in different planes, are of great value with reference to the physics of intra-pericardial and intra-cardial pressure. The pseudo-Hippocratic view of the heart as a muscle, maintained by Harvey, Richard Lower and Stensen, was confirmed by Leeuwenhoek (*Arcana naturae,* 1695), who first described cardiac muscle and showed a certain structural similarity to ordinary striated muscle. The discovery of a new layer of spiral fibres by Krehl, MacCallum and Mall confirmed Harvey's view of lengthwise shortening of the ventricles in systole and brought out the view

of a stationary heart rotating on its long axis (d'Irsay). Extravital autonomy of the excised heart, known to Galen, was maintained by Harvey and established by Haller, who regarded the continual flow of blood in the heart as the primary stimulus of the mechanism, conditioned by the "irritability" of cardiac muscle. This myogenic view of the heart's autonomy was confirmed by the experiments of Gaskell (1882) and Engelmann, who demonstrated the automatic rhythmic contractile power in isolated strips of cardiac muscle. Meanwhile, the vagus nerve, known to Rufus of Ephesus, had long been regarded by many observers as the motor nerve of the heart, and the introduction of electric stimulation by Galvani (1792) tended to confirm this view. This neurogenic theory of cardiac action was disposed of by the brothers Weber (Omodei's *Annali,* 1845), whose experiments demonstrated that the action of the vagus is inhibitory, while Gaskell's great memoir on the vagus (1882) indicates that its function is regulatory, acting on occasion as spur and bridle, whip and snaffle to the heart, while motor influences originate from the ganglia discovered by Bidder (1852) in the sinus venosus. In 1855, Claude Bernard showed that stimulation of the first sympathetic ganglion in the left side of the thorax will revive a quiescent heart (Bezold, 1863). Finally, in 1902, Friedenthal confirmed autonomy by eliminating all the nerves. In Ludwig's laboratory, H. P. Bowditch first made an isolated heart beat in delphine solution (1871), demonstrated the step-wise contraction (*Treppe*) of cardiac muscle (1871) and (with Kronecker) that it will contract to the maximum extent or not at all ("All or none" 1871). Ringer's solution (1880-83), identical, for practical purposes, with the composition of the blood, indicated that the stimulus, if chemical (Haller), may reside in the blood itself. Thus, even as Goethe's Mephistopheles affirmed the blood to be *sui generis,* it became apparent that cardiac muscle differs from other muscle in obeying laws all its own. Concerning the neurogenic and myogenic theories of cardiac action, d'Irsay inquires: "Is there any thing essential at stake in the

whole problem? Is there any real problem? It does not touch the nature of the stimulus, nor the final reaction to stimulus (contraction) but seems to boil down to a question of conduction. . . . The experiment clears the importance of one, two, five factors and yet life operates with hundreds of them." We approach, then, the problem of the origin and situs of conduction in the autonomous heart. Long ago, Galen noted that the right auricle is the last part of the body to die. Harvey (IV) even affirmed that the blood in the right auricle palpitates "as if imbued with life and spirit," after the auricle itself has ceased to beat, and concludes that "whether life begins with a cardiac palpitation is doubtful." He thus transfers the primacy of the heart to the blood (the *punctum saliens* of Aristotle) and reasons that "What is made last in animals dies first, what first dies last." Harvey, indeed, found his *impetum faciens* of the heart beat in the "innate heat" of the blood, *i. e.* its oxygenation (Allbutt). He was, however, the first to notice that "the movement, seems to start in the auricles and to spread to the ventricles" (IV) and that "these two motions . . . are consecutive, with a rhythm between them" (V). The mystery of this auriculo-ventricular rhythm, which Harvey likened to the mechanism of swallowing, was first illuminated in the celebrated experiment of Stannius (1852), *i. e.* a ligature applied at the sino-auricular junction will stop the heart; a second ligature at the auriculo-ventricular groove will set up slow ventricular beats. The locus of inhibition and conduction lies, then, in the auriculo-ventricular region. Harvey, in fact, describes physiological heart-block as follows: "While the heart gradually dies, it sometimes responds with a single weak and feeble beat to two or three pulsations of the auricles" (IV). Muscular continuity between auricles and ventricles was first noted in reptiles by Gaskell (1883). Then came the discovery and description of the auriculo-ventricular bundle in mammals by Kent and the younger His (1893). Then Tawara's mapping out of the junctional or conductive system of the mammalian heart (1906), finally the discovery of the sino-

auricular node, the pace-maker of the heart, by Keith and Flack (1907). Before 1893, muscular conduction between auricles and ventricles was unknown and unthinkable. Meanwhile electric currents from contracting cardiac muscle had been demonstrated with the galvanometer by Matteucci (1843), in Kölliker's rheoscopic frog effect (1856), with Lippmann's capillary electrometer by Burdon Sanderson and Page (1878), by Gaskell (1881-2), and by A. D. Waller (1889), who subsequently utilized the Einthoven string galvanometer (1903) in the development of human cardiography (1907-8). With the polygraph, Sir James Mackenzie made his important studies of the pulse (1902) and with Sir Thomas Lewis, Wenckebach and others, developed the new science of the cardiac arrhythmias. In 1883, Wooldridge demonstrated innate rhythmicity in the total myocardium, in accordance with the reasoning of Gaskell (1882). The instrumentation for graphic records of these findings was afforded in Ludwig's invention of the kymograph (1847), in the sphygmograph (Vierordt, 1855, Marey, 1860), in plethysmography (Mosso, 1874) and phonocardiography (Hürthle, 1892-5). Estimates of blood-pressure began with the experiments of Stephen Hales (1723), were continued by Thomas Young (1808-9) and Poiseuille (1828-60), whose mercury manometer (1828) was made to record its findings by Ludwig (1847). Capillary blood-pressure was first investigated by von Kries (1875). Clinical estimates of blood-pressure were first made by Vierordt (1855). The sphygomomanometer of von Basch (1887) was modified and improved by Potain (1889), Riva Rocci (1896), Gaertner (tonometer, 1899) and by C. J. Martin, who revived the mercury column of Poiseuille (1905). Korotkoff added auscultation (1905), which made the method applicable to every condition except aortic regurgitation (Rolleston). The heart sound was first noticed by Harvey and was elucidated by Wollaston (1810), Laennec (stethoscope, 1819) and Turner (1829). The second heart sound was first described by Talma (1880) and the third by A. G. Gibson (1907) and Thayer (1908). Measurement of the velocity of

the blood-current was first made possible by the *Stromuhr* of Ludwig and Dogiel (1867). Harvey's original stroke-volume estimates of cardiac output were rough approximations, amounting virtually to an algebraic proof of his final argument. Estimates of total cardiac output have since been made by four different methods (Leake). The basal output has been found by Grollman to be a linear function of the surface area of the body (1929),[20] amounting ordinarily to 2.2±0.3 liters per square meter per minute. In 1829, Hering showed that the heart is never emptied. Hence, the main thing in Harvey's rough guesses was not so much the matter of meticulous computation as the mathematical accuracy of his reasoning. In 1748, according to d'Irsay, Daniel Passavant, accepting Harvey's estimate of cardiac output (1½ ounces) and Stephen Hales' estimate of systolic pressure (8 feet), computed that the work done by the heart in an hour is equivalent to lifting 375 pounds to the height of 8 feet (400 kilogram meters). Tigerstedt got 343 kilogram meters. The discrepancy is due to the fact that, in all general equations or general formulæ in mathematical physics, friction, viscosity and other very real sources of dissipation of energy are apt to be overlooked. Down to the middle of the 19th century, the pulse was regarded as the tactile index of the blood-current, like the tick of a watch, and was thought to be synchronous in all arteries (d'Irsay). This error was corrected by the demonstration of wave motion within the blood-vessels and its consequences, by the Weber brothers (1850). Henle's discovery of vaso-motor nerves (1841), Claude Bernard's experiments on vaso-constrictor and vaso-dilator effects (1851-8), the elucidation of the depressor nerve by Ludwig and Cyon (1866), the new view of the capillary circulation gained by Dale (1918-19), Krogh (1922), Lewis (1927) and others under capillary microscopy (Lombard, 1912), the vaso-dilator effect of histamine upon the capillary endothelium (Dale)—all these are tied

[20] A. Grollman: *Am. J. Physiol.*, 1929, XC, 210. Cited by Leake.

up with mooted questions in recent physiology which would lead us too far. Concerning the question of chemical activation of cardiac muscle by carbohydrates or $CO_2$ or of vaso-dilation by histamine and of vaso-constriction by adrenaline, d'Irsay cites the dictum of Langendorff (1884): "The cells are activated by their own vital products" (*Das Lebensprodukt der Zelle ist ihr Erreger*).

These advances in the physiology of the circulation were not without their effect upon our knowledge of its disorders. In the first half of the 19th century, however, physicians were occupied largely with valvular murmurs, in consequence of the novelty of auscultation by the stethoscope and the refinements in physical diagnosis exploited by Laennec, Bouillaud and Skoda. Laennec, himself, was occupied mainly with the respiratory system and did little for heart disease. He followed his teacher, Corvisart (1806), in stressing the myocardium as "the key to cardiac pathology." Corvisart revived palpation (Albertini) and percussion (Auenbrugger) and, in his treatise on heart disease (1806), reported cases of endocarditis and tricuspid stenosis, and first described sclerosis of the pulmonary artery. Laennec described toxic febrile myocarditis, fatty degeneration of the myocardium and dissecting aneurism (Nicholls, 1760). His greatest contribution to the subject was, of course, the stethoscope, with which he noted some of the physical signs of pericarditis (Senac, 1749). Rheumatic pericarditis was described by Andral (1829), and the association of pericarditis with chorea was noted by Richard Bright (1839). Griesinger (1856) described chronic adhesive mediastino-pericarditis, with the characteristic intermittent pulse during respiration (*pulsus paradoxus,* Kussmaul, 1874). Endocarditis, first described by Corvisart (1806) and Andral (1829), was named by Bouillaud (1836) and was largely his creation. As early as 1788, endocarditis was correlated with acute rheumatism by David Pitcairn, in his lectures at St. Bartholomew's Hospital, but he left no record, beyond the testimony of the elder Latham and Matthew Baillie, and Jenner's contribu-

tion of July 29, 1789, was also lost (H. B. Jacobs). The textual record begins with W. C. Wells' paper of 1812 and the subject was developed *in extenso* (law of coincidence) by Bouillaud (1836-40). Malignant endocarditis was noticed, but not recognized as such, by Corvisart (1806), Hodgson (1815) and Bouillaud (1836), and was first described by Senhouse Kirkes (1852). The chronic subacute form (endocarditis maligna lenta) was first mentioned in Osler's Goulstonian Lectures (1885) and was described by Osler and Horder (1909). Subacute bacterial endocarditis (Barlow and Rees, 1843) was established by Libman and Schottmüller (1910). Up to 1840, cardiac aneurism was confused by the earlier writers with myocardial hypertrophy and dilatation. Genuine cases were seen by Galeati (1751) and Matthew Baillie (1818), but the matter was first clarified by Thurnam (1838) and Wickham Legge (1840-83). Cardiac hypertrophy was first correlated with renal disease by Richard Bright (1827-36). The effect of physical overstrain was emphasized by Hope (1839), Peacock (1864) and Clifford Allbutt (1870-1909). DaCosta's irritable heart in soldiers (1862-71) was confused with the D. A. H. of the World War, which resolves itself into the "effort syndrome" of Lewis (1917). Fatty myocardial degeneration was first correlated with Cheyne Stokes respiration (1816) and with heart-block with slow pulse (Stokes Adams syndrome, 1827-46) by Stokes (1854). Alcoholic dilatation and hypertrophy was recognized by Allbutt at Leeds (1871) and described by Graham Steele (1893). Congenital malformations of the heart were first noticed by Senac (complete absence of interventricular septum, 1749) and Morgagni (pulmonary stenosis, 1761), and were investigated by Bouillaud (1835), Peacock (1858), Rokitansky (1875), Sir Arthur Keith (1906) and Maude Abbott (1908). Bouillaud attributed them to arrested development and fœtal endocarditis. Keith found most of them to be due to arrested development of the bulbus cordis. The cyanosis was attributed by Senac to admixture of arterial and venous blood, by Morgagni to venous stasis. Partially defective septum without cyanosis was described

by Roger (1879) and called after him (*maladie de Roger*). Experience of the World War seems to confirm the view of Laennec and Rokitansky that congenital heart disease (cyanosis) is antagonistic to tuberculosis (Rolleston).

Of the valvular diseases, mitral regurgitation was known to Morgagni (1761), mitral stenosis, aortic regurgitation and aortic stenosis were described by Vieussens (1715), tricuspid stenosis by Crüwell (1765), Morgagni (1769), Corvisart and others, and tricuspid incompetence by Lancisi (1728). The physical signs of these lesions were correlated mainly by James Hope (1832-9), who established the cause of the heart sounds by vivisection, and made a thorough investigation of the pathology of mitral incompetence. Hope's diastolic murmur in mitral stenosis (1832) and his "jerking pulse" in aortic regurgitation (1839) were memorable eponyms in their day. Notable descriptions of aortic incompetence were those of Thomas Hodgkin (1829) and Corrigan (1832). The presystolic murmur was described by Austin Flint (1862-86). Operative treatment of mitral stenosis was proposed by Lauder Brunton (1902), tested experimentally by Cushing and Branch (1908) and done on man by Cutler (1923) and Souttar (1925). Aortitis was described by Morgagni (1761) and Virchow (1847); coarctation of the aorta by Paris (1789), Laennec (1826), Reynaud (1828), Peacock (1866) and Bonnet (1903). Arteriosclerosis was found by Sir Armand Ruffer in Egyptian mummies 3000 years old (1911), was noted in Harvey's second epistle to Riolanus (1649), was named by Lobstein (1833) and elucidated as an inflammatory process by Bouillaud (1824) and Virchow (1847). Arterio-capillary fibrosis, with occasional impact on the kidneys, was described by Gull and Sutton in 1872. The pre-albuminuric stage was described by Mahomed in 1879. The term "atherosclerosis" was introduced by Marchand (1904), to indicate that the initial process is degenerative, rather than inflammatory. Pseudo-arteriosclerosis during Bright's disease was described by Moschcowitz (1928), thrombo-angiitis obliterans by Buerger (1908).

Essential, non-renal high blood-pressure (hyperpiesia) was described by Clifford Allbutt (1895) and shown to be productive of arteriosclerosis in the elderly. Syphilitic arteritis was described by Allbutt (1868), Heubner (1874) and Barlow (1877). Cyanotic polycythæmia was described by Vaquez (1892) and the splenomegalic form by Osler (1903). The form associated with sclerosis of the pulmonary artery and terminal failure of the right heart was called *cardiacos negros* by Ayerza (1901) and described as Ayerza's disease by Arillaga (1913).

The classical account of angina pectoris is that of Heberden (1768), who reported 20 cases, gave the disease its name, and by 1801, had seen 100 cases. Seneca's epistles to Lucilius record his sufferings from the condition, which ended John Hunter in 1793. Hunter's case was diagnosed by Jenner (1777), who, with Hunter, first associated angina pectoris with obstruction from hardening of the coronary arteries (1776). In the view of Allan Burns (1809), this produces an anæmia (anoxæmia) of the cardiac muscle, such as obtains in the intermittent claudication of Bouley (1831) and Charcot (1858). That the lesion is in the base of the aorta was maintained by Corrigan (1837) and sustained by Allbutt (1894) and Wenckebach (1924). Amyl nitrite therapy was introduced by Lauder Brunton (1867), cervico-thoracic sympathectomy by Jonnesco (1916) and peri-arterial sympathectomy by Leriche (1917-22). The detailed history of angina pectoris has been carefully analyzed in Rolleston's Harveian Oration (1928). Cardiac asthma was differentiated from angina pectoris by Heberden (1768) and first clearly defined by Sir James Mackenzie (1911). Coronary thrombosis, first noted by Harvey in his second disquisition to Riolan (1649), was described in detail by Obrastzon (1910), J. B. Herrick (1912), Parkinson and Bedford (1928). Heart-block with slow pulse (Stokes-Adams syndrome) was first observed by Morgagni (1761) and was described by Heberden (1768), Andrew Duncan (1793), Adams (1827), Bright (1831) and Stokes (1846). Physiological heart-

block was noted by Harvey (1628) and elucidated by Gaskell (1882). Stokes-Adams disease became generally known in practice through the writings and teachings of Osler (Rolleston). Exophthalmic goitre was described by Parry (1786-1813), Flajani (1800), Graves (1835) and Basedow (Merseburg triad, 1840).

Pulse-counting by the watch, introduced by Floyer (1707-10), was as he predicted, ignored for a century or more, even by Corvisart (1808), and first came into its own at the hands of Stokes, Graves and Corrigan. Parry published an experimental study of the pulse in 1816. Hope analyzed the pulse in 10,000 patients with valvular disease (1831) and Mackenzie studied it with the polygraph (1892), after which, less importance was attached to cardiac murmurs (Rolleston). Mackenzie distinguished *pulsus alternans* and *pulsus irregularis perpetuus* (1902) as a "nodal rhythm" (1907). In 1910, this pulse was shown by the electrocardiograph to be associated with the auricular fibrillation of Cushny and Edmunds (1901-6). Auricular flutter was produced experimentally by MacWilliam (1887) and elucidated clinically by Sir Thomas Lewis and others (1920-21). Ventricular fibrillation was produced experimentally by Ludwig and Hoffa (1850) and Kronecker (1884) and was described as a cause of sudden death by MacWilliam (1889). Paroxysmal tachycardia was described by Cotton (1867), Carl Gerhardt (1881) and Bouveret (1889). The science of the cardiac arrhythmias, including analysis of the effects and dangers of digitalis and quinine in auricular fibrillation, was developed mainly by telegrams from the heart (string-galvanometer) and was largely the work of Mackenzie, Lewis and Wenckebach. Digitalis was first described by the medical botanist, Leonhard Fuchs (1542), was introduced as a diuretic in dropsies by Withering (1775-83) and as a cardiac sedative by Cullen (1789) and John Ferriar (1799), who first noticed that it slows the pulse. Sahli showed that therapeutic doses in man do not raise the blood-pressure (1901). Mackenzie (1910) and Cushing (1925) dispelled current

fears as to its use in heart-failure. In like manner Wenckebach (1914), Lewis (1922) and others showed that quinidine and other cinchona derivatives will restore the rhythm in auricular fibrillation and flutter, if so administered that the Keith-Flack pace-maker may gain control without poisoning of the myocardium (ventricular fibrillation).

Aneurism was the starting point of the brilliant developments of surgery of the vascular system, from Antyllus to Carrel. At the end of the 18th century, the theory of syphilitic origin of aneurism, although upheld by Lancisi and Morgagni, was ignored, even by Matthew Baillie, and although revived about 1850, was really confirmed by the presence of the Schaudinn spirochæte (1905) and the Wassermann reaction (1906). Arterio-venous aneurism was described by William Hunter (1757). Dissecting aneurism was discovered in the body of George II by Frank Nicholls (1760), whose findings were confirmed by Laennec, Peacock and others. Embolic aneurism was described by W. S. Church (1870) and Ponfick (1873), and its congener, periarteriitis nodosa, by Kussmaul and Maier (1866). In the 18th century, treatment of aneurism by the Valsalva rest-starvation cure, with light bloodletting (*supra*), was the most popular and was revived (without venesection) by Tufnell (1874). Attempts at coagulation by exhibition of iodide of potassium (Nélaton, 1859), gelatine injections (Lancereaux, 1897), wire coils (Baccelli) and coagulene (Kocher-Fonio) followed. John Hunter's ligation of the femoral artery for popliteal aneurism (1786) was repeated by his American pupil, Wright Post (1796), who was also successful in tying the common carotid (1813), the external iliac (1814) and the subclavian (1817). John Abernethy was successful in two ligations of the external iliac out of four (1796-1809). John Bell ligated the gluteal artery in 1801. Astley Cooper was the first to ligate the carotid with success (1808) and even essayed ligation of the aorta (1817). His pupil, Valentine Mott, did more successful ligations of great vessels than perhaps any other surgeon, notably of the innominate

(1818), the common iliac (1827), the external iliac (1831), the right subclavian (1833) and the internal iliac (1837). Mott's account of Cooper's attempt to ligate the subclavian, on August 20, 1809, reveals the fact that opium was frequently given in massive doses to stupefy and quiet the patient during these difficult and dangerous procedures. Up to the introduction of ether and chloroform anæsthesia (1847), there was a remarkable run of bold operating on the great vessels. Thus, the external iliac was tied by Dorsey (1811), Goodlad (1811), Soden (1816), Cole (1817), Dupuytren (1827), Jameson (1821), Aston Key (1822), White (1827) and Peace (1841), the subclavian by Colles (1811-13), Dupuytren (1819), Aston Key (1823) and Rodgers (1846), the innominate by the elder Graefe (1822), the common iliac by Bushe (1830) and Peace (1843); while, with the aid of anæsthesia, we find such feats as successful and simultaneous ligation of the external and common iliac, the femoral and the profunda by Gurdon Buck (1858), the common, external and internal iliac by Syme (1862), the left subclavian, common carotid and vertebral by Willard Parker (1864). The most remarkable feat of this kind was the ligation of the innominate, common carotid and right vertebral arteries for subclavian aneurism by Andrew W. Smyth, of New Orleans (1864), with exhibition of the living patient in 1869. The specimen can be seen in the Army Medical Museum (Washington). With the introduction of antisepsis came the innovations of Lister (1869-80), Halsted's method of occluding the great vessels by a metal band (1909), Murphy's experiments on end to end suturing (1896), arteriorhapy (Matas, 1903) and the most important of all, Carrel's substitution of vascular anastomosis for the older methods (1902-7) and his experiments on transplantation of blood-vessels (1909). Suture of the heart was first done by Farina (1896) and Cappelen (1896) and successfully by Ludwig Rehn (June 8, 1896). Cardiac surgery is now a well established procedure.

There are two important therapeutic devices which owe their origin to Harvey's demonstration, namely transfu-

sion and hypodermic medication. Transfusion, first essayed in animals by Richard Lower (1665) and in man by Jean Denys (1667), Lower and King (1667), went out of fashion, as Rolleston says, for a long time thereafter. It did not come into practice again until the period 1818-76, after which it again went into abeyance until it acquired a scientific status through the improved technique of Crile (1909) and Landsteiner's work on blood-grouping and its consequences (1899-1901). Intravenous medication in animals was attempted by Christopher Wren (1656) but hypodermic injection came in with the invention of the needle syringe by Rynd (1845), and its improvement by Pravaz (1851). Morphine injections in heart disease were first recommended by Sir Clifford Allbutt (1869).

Even the most superficial survey of the history of the circulation and its consequences will convince any fair-minded observer as to the superiority of Harvey's experimental proof over the summary of Cesalpinus, whose speculations were, to some extent, anticipated by the Spanish anatomists who preceded him. Had investigation stopped where Cesalpinus left it, knowledge would have remained at a standstill. The outcome of Harvey's demonstration covers many of the most important advances made in recent medicine and does but confirm his position as the founder of modern experimental physiology and as one of the great leaders of European thought.

FIELDING H. GARRISON.

# RECENT CONTRIBUTIONS IN DISEASES OF THE THYROID AND DIABETES*

By Walter W. Palmer

The contributions to the field of metabolism in recent years have been many; some of real service to the practicing physician and a few of the greatest importance to both the physician and the physiologist. In the realm of the hormones and special food products operative in metabolic disturbances, the past two decades have witnessed an advance in our knowledge of the chemistry and physiology of these vital substances greater than in any similar period. An enumeration of some of the outstanding developments is truly impressive; insulin for diabetes, thyroxin for thyroid insufficiency, parathormone for parathyroid tetany, the sex hormones, adrenal cortex extract, liver extract for pernicious anemia, and vitamines for the deficiency diseases. The significance of the minerals in relation to nutrition in general and special functions has been made more certain. Much light has been shed on the complicated mechanism of electrolyte balance in nephritis, diabetes, and intestinal disturbances. We are informed that manganese is necessary for mother love! All of us should take pride in the fact that the advance in the several fields has been due to a considerable extent to the work of men in the United States and Canada.

The literature for the period comprises thousands of articles, many monographs and books. A comprehensive review would be quite impossible in a short paper. It is proposed in this communication to mention briefly some of the recent work in thyroid disease and diabetes mellitus.

## Diseases of the Thyroid Gland

For the practitioner, probably, the most useful contributions to the thyroid problem during the past twenty

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years are the introduction by Benedict (1) of an apparatus for the determination of basal metabolism adapted to clinical needs and the revival of the use of iodine by Plummer (2) for the temporary control of thyrotoxicosis. Today most hospitals and many physicians' offices are equipped with some sort of a simple machine to estimate basal metabolic rates and it is rare now to discover an individual who is subjected to thyroidectomy without first receiving iodine in some form, usually as Lugol's solution. From a practical standpoint progress in the field during the past two or three years does not compare in importance. No discussion of the subject is possible without the mention of the isolation of thyroxin by Kendall in 1919 and the brilliant work of Harrington (3) in the simplification of the method of extraction and in presentation of the evidence of its chemical constitution culminating finally in synthesis of the product by Harrington and Barger (4). The crucial test has shown that the synthetic compound is physiologically active (5). Thyroxin is the p-oxydiiodophenyl ether of diiodotyrosine. Of further interest in the relation of diiodotyrosine to the constitution of thyroxin is the isolation by Harrington and Randall (6) of diiodotyrosine from the thyroid gland. The connection between this substance and thyroxin would seem to be important.

*Deficiencies of the Thyroid Gland*

The literature up to 1929 on the rôle of iodine in nutrition with special reference to the incidence of goitre has been admirably reviewed by Orr and Leitch in a special report published by the Medical Research Council, England (7). In America, McClendon and Hathaway (8) have shown the higher incidence of goitre in areas where the iodine content of the water and food-stuffs is low. Similar observations have been made by von Fellenberg for Switzerland (9) and Hercus and collaborators (10) for New Zealand. Furthermore, it has been demonstrated by Marine and coworkers (11) and Silberschmidt (12) that the administration of iodine in the goitre areas is

followed by a marked decrease in incidence of goitre particularly among school children. A recent report from Orr (13), England, is not in entire agreement with previous work in that no definite correlation between the incidence of goitre and iodine low areas could be established. Orr is of the opinion that while the administration of iodine appears to prevent the development of goitre the question of whether iodine deficiency is the sole cause of the disease is an open question. In this connection experiments reported by McCarrison and Newcomb (14) are of interest. These workers find that rats fed a low iodine diet markedly deficient in vitamine A do not develop goitre when kept meticulously clean but under less sanitary conditions develop goitres which can be prevented by the addition of iodine to the food.

That iodine deficiency may not be the sole factor in the production of simple goitre receives further support in the significant observations of Webster, Chesney and Marine (15). A substance in cabbage, particularly winter cabbage, not extractable by water, heat, acid and alkaline stable produces goitre of extraordinary size (400 times normal size), in rabbits. An excess of iodine added to the food, however, will prevent the development of the goitre. On the other hand large doses of iodine administered after the goitre is developed produces a rapid involution, increased metabolism, wasting and death, a true picture of hyperthyroidism. It may be mentioned here that we have found in our thyroid clinic at the Presbyterian Hospital that children and young adults with simple goitre with few exceptions are little benefited by the administration of iodine. This seems to be contrary to the experience of physicians in the low iodine areas who report that usually iodine administration is followed by the diminution of the size of the gland.

Shortly after Kendall isolated thyroxin Boothby and associates (16) reported that the physiological activity of the hormone was essentially equivalent to the whole gland. There was, however, a delay in the effect over that

of whole gland. Quantitative relationships indicated that one milligram of thyroxin raised the basal metabolism of the average individual two per cent. The effectiveness of the hormone appeared to be the same as the whole gland. From time to time clinicians have expressed some scepticism of the validity of this view and recently experiments which bear on the subject have been reported. Gaddum (17) using rats as test animals finds that thyroglobulin is much more effective in increasing oxygen consumption than is thyroxin when compared to their iodine contents. Employing the rat test method of assay Cameron and Carmichael (18) find that natural and synthetic thyroxin exhibit the same degree of activity but this is not as great as thyroid gland itself when compared on the basis of iodine dosage.

Another difference between thyroxin and whole gland is reported by Abelin (19) who finds the change of carbohydrate to glycogen in the liver is impaired to a great degree after the administration of the former. The physiological differences between thyroxin and whole gland reported seem to have considerable support. It is believed that the hormone is not utilized in the organism in its isolated form but probably as thyroglobulin. Schulhof (20) was not able to demonstrate thyroxin in the blood and lymph vessels of the thyroid gland but did find thyroglobulin. In practical therapeutics it would appear that thyroxin has little advantage over the whole gland, perhaps some disadvantages. In any event it is far more expensive. Difficulty still exists in the assays of thyroid gland preparations. The U.S.P. standards are based on organic iodine content. Harrington (21) has recently shown that the amount of thyroxin in commercial preparations does not always parallel the iodine content and urges therefore that the preparations for therapeutic use be assayed by determining the thyroxin content rather than the iodine. Biological assays are treacherous. Perhaps the one most generally accepted, the acetronitrile test proposed by Hunt, is the most reliable. Recently Morch

(22) has suggested utilizing the effect of thyroid preparations on gaseous metabolism of mice as a method of assay. The method has a large error and is time consuming. It would seem that the chemical assay suggested by Harrington offered the best possibilities, provided the quantitative results are dependable and the activity of the gland is due solely to its thyroxin content.

Since the determination of the basal metabolic rate has been made easy, there have appeared an increasing number of reports (23) (24) (25) of cases with low basals without the clinical manifestations of myxedema. Although these cases are considered to be suffering from hypothyroidism there are several features which may be overlooked. Dubois (26) and Rabinowitch (27) call attention to the large errors which may creep into the determination itself as well as its interpretation. It should be remembered that the Aub-Dubois standards are too high for many individuals; trained subjects give more reliable results than untrained, muscular tone and the activity of the individual before the determination, the state of nutrition, temperament and previous dietary, all may influence the value. Undoubtedly some of the cases described seem to be benefited as the result of thyroid administration, their basals return to within normal limits, they are clinically improved and quite properly may be suspected as suffering from thyroid insufficiency. Koehler (28) suggests an interesting differentiation in the patients he observed. He calls attention to the frequency within this group of symptoms of languor, fatigability, asthenia, restlessness and nervousness. Some of these patients with low basals are suffering from thyroid insufficiency, others from insufficiency of the adrenals. The former are usually overweight, with low blood pressure, sluggish, low respiratory curve (observed when determining the basal metabolic rates) insensitive to anoxemia, adrenalin and histamin, and improve on the exhibition of thyroid extract. The latter are thin, also with a low blood pressure, hyperactive, the respiratory curve

erratic, sensitive to anoxemia, adrenalin and histamin, and improve on the administration of adrenal extract. Unfortunately for the present adrenal extract is not available for general use, and as yet no confirmation of his observations has appeared. The recent work of Swingle and Pfiffner (29) who have succeeded in obtaining an extract of the adrenal cortex capable of maintaining adrenalectomised cats in a normal state indefinitely is encouraging. Not only may there be available an extract of adrenal gland effective in the milder insufficiencies, if there be such, but also in true Addison's disease as suggested by the report of Rowntree and associates (30) who apparently have prolonged the life of several cases of this disease.

The association of obscure secondary anemias with low basal rates has been observed by Mackenzie (31). In the cases he reports the rapid return of the hemoglobin and red blood corpuscle count to normal after the ingestion of thyroid gland in the absence of other hematinic measures would indicate that hypothyroidism played an important rôle in the production of the anemia in cases under discussion.

*Graves' Disease*

In spite of the vast amount of study and investigation of Graves' disease, for the present the etiology of the condition remains as obscure as ever. The disease as it exists in man has not been produced in animals. The most suggestive approximation is the familiar cat experiment of Cannon, Binger and Nye (32) who fused the right phrenic to the right cervical sympathetic nerve resulting in marked tachycardia, diarrhœa, falling hair, excitability, an increased basal metabolism and in one cat an exophthalmos on the side of the fusion. Investigators have had difficulty in repeating these experiments. Marine's (33) experiments would indicate that the adrenal cortex may play a rôle in the production of the picture. Injury to the cortex in cats and rabbits with the thyroid intact is followed by increased metabolism, increased appetite, irritability, hypersusceptibility to drugs associated with a hyperplasia

of the thyroid gland, thymus and lymphoid tissue. While the view that Graves' disease is essentially a disease of the thyroid gland still prevails Marine is of the opinion that the adrenals and possibly the sex glands may play an important part in its causation. Certain it is that many of the symptoms of the disease may be produced temporarily by feeding thyroxin or the gland and the evidence available indicates that in Graves' disease the thyroid gland instead of storing thyroglobulin to be utilized as is needed under normal conditions cannot prevent the hormone from flooding the system. Using von Fellenberg's method for the determination of organic iodine in the blood Lunde (34) and assistants find markedly increased amounts of organic iodine in the blood of patients with Graves' disease. After operation or the administration of Lugol's solution the organic iodine values approach normal. Other observers report similar results. Gutman, in my clinic, has spent a year working with the method used by Lunde and has come to the conclusion that the method is not only time consuming and laborious but not altogether reliable. Provided Lunde's results have any significance they would favor the supposition that the increase in organic iodine in the blood of patients ill with Graves' disease is circumstantial evidence that there is an increase in thyroxin in the circulation. Attempts to increase the hormone output of the thyroid gland by stimulating the peripheral end of the cervical sympathetic, the intravenous injection of adrenalin and pilocarpin and massage of the gland have failed in the hands of Hektoen, Carlson and Schulhof (35).

Although a clear cut physical basis for the etiology of the disease is lacking, the association of some psychic trauma in a constitutionally susceptible individual with the onset of symptoms has long been recognized by clinicians. This relationship has been discussed recently by Moschcowitz (36). A detailed study by Dr. Conrad of the psychiatric patterns of Graves' disease patients in the clinic at the Presbyterian Hospital records striking similarities. Mother child conflicts, sexual maladjustments

and the sense of being overburdened appear with great frequency in the histories.

The hypothesis has been advanced that in certain of the cases of thyrotoxicosis the thyroid gland elaborates a pathological secretion which produces the symptoms. Formerly Plummer suggested that true Graves' disease might be due to an incomplete iodizing of the hormone while in patients with nodular glands toxic symptoms were probably caused by the over-production of the normal active principle. The evidence in support of this view is not at present entirely convincing. Recent pathological studies (37) and clinical experience would indicate that there is little difference fundamentally between the toxicosis encountered in the so-called simple hyperplastic gland or primary Graves' disease and the nodular thyroid gland or secondary Graves' disease. The difference in clinical behavior is more probably due to the stage of the disease (33). Williamson and Pearse (38) suggest the existence of two functions of the thyroid gland, a secreting function and an iodocolloid function. The secretory activity is believed to be related to thyrotoxicosis for this condition is ameliorated by simple removal of pure secreting tissue. Iodocolloid is considered to have only an indirect relation to the thyrotoxicosis. The behavior of the gland following the administration of iodine in their opinion supports this view since we may continue to get toxic symptoms in the presence of iodocolloid reserve in the gland. By stimulating normal thyroid glands Ludford and Cromer (39) observed the Golgi apparatus to increase in size, secretion droplets appear, enlarge and make their way into the colloid material. In hyperthyroid glands, however, the secretion makes its way directly into the capillary. Because of the probability that normal iodocolloid is composed of two types of secretion the authors consider the facts described above as presumptive evidence in favor of a qualitative difference in the secretions of the thyroid gland in exophthalmic goitre.

Although in diagnosis little difficulty in the average case

may be encountered many so-called border-line cases often present perplexing problems. These situations are most frequently seen in individuals of the psychoneurotic type. Since the introduction of the basal metabolism test perhaps too much reliance is placed in this single bit of evidence. Probably many clinicians have seen cases similar to those published by Strouse and Binswanger (40) in which there is a symptom complex resembling hyperthyroidism without increased basal metabolic rates. These patients complain of vague gastro-intestinal symptoms, dizziness, sleeplessness, lack of energy, palpitation, excitability, headaches and vasomotor disturbances. They seldom exhibit exophthalmos, may or may not have an enlarged thyroid gland, usually have a distinct tremor of the fingers and tachycardia. The basal rates are within normal limits. The picture resembles closely that seen during the war designated as effort syndrome or neurocirculatory asthenia. Many of these cases seem to be strikingly benefited by the administration of iodine in therapeutic doses without any influence on the basal metabolism. In view of the large psychoneurotic element in these individuals conclusions must be drawn with caution. An ingenious suggestion in the differentiation of these cases has been made by Dresel and Goldner (41) (42) supported by Willis and Mora (43). These authors find that under the conditions of their experiment the injection of serum from thyrotoxic patients impairs the glycogenic function of the livers of mice to a greater degree than does normal serum. Since the pathological serum is from 50 to 100 times as effective as might be expected on the basis of its thyroxin content, these authors believe there is some substance other than thyroxin operative. The protagonists of the hypothesis that pathological glands secret a qualitatively different secretion might consider this evidence as further support of their contention. The test takes about 80 hours to complete, is fairly simple and the proposers believe has useful possibilities as a biological test in borderline cases, for the study of the thyrotoxicosis in humans and for controlling experimental hyperthyroidism.

*Treatment*

So far as treatment of the thyrotoxicosis is concerned the belief that no matter how carried out, skillful neglect, iodine, X-ray or surgery, the course of the disease is seldom less than three or four years, is probably not far from correct. The predominant view, however, is that in properly selected cases the one form of treatment which offers most relief to the patient with early return to economic stability and social activity is subtotal thyroidectomy at the hands of a competent surgeon. The introduction of the use of iodine in preparation for operation and post-operative control constitutes the most significant advance of the past few years. Certainly in middle life and the elderly, surgery, where possible, with prompt relief to the cardiovascular system would seem to be the wisest course in treatment. It has been amply demonstrated now that the use of iodine in the nodular glands is as safe as in the primary Graves' cases although frequently its effect is not so striking (33) (44). When the spectacular temporary effects of iodine were first observed the hope to do away with surgery was entertained. Prolonged treatment with small doses (45) and interrupted administration of iodine has proved effective in controlling the symptoms in a few mild cases (46). For general use it has proved disappointing, since in most cases after the first two or three weeks of ingestion with the extraordinary subsidence of symptoms there is a gradual return to the initial state. Although 1 c.c. or more of Lugol's solution is the conventional daily dose Thompson and associates (47) have shown that extremely small doses, one drop of Lugol's solution corresponding to 6 milligrams of iodine daily will produce a marked beneficial effect on the symptoms and lower the basal metabolism. This author suggests that only five drops of Lugol's solution daily produces the optimum effect and is all that is necessary in preparation for operation. The impression that once iodine has been used in the medical treatment of a case of thyrotoxicosis, it is never so effective again, in the event its use is needed in preparation for operation, in the author's experience, has no basis in fact. In our clinic at the Presbyterian Hospital there have been several

opportunities to observe the beneficial effect in cases having received iodine over long periods but after a month to six weeks without iodine a re-exhibition of the drug resulted in the desired effect. In this connection may be mentioned some studies Palmer, Sloan and Carson (48) have made on the effect of iodine on the excretion of creatin in cases of thyrotoxicosis. Iodine administration is followed by a prompt (3-7 days) reduction in the excretion of creatin, indeed, in many cases, it disappears altogether from the urine. Cases which we have had the opportunity to study and have previously taken iodine over long periods if allowed to rest without the drug for several weeks respond so far as the creatin excretion is concerned as do the untreated cases. Occasionally the behavior of the creatin is independent of the change in the basal metabolism.

The possible effect of vitamines A and D on the utilization of iodine in Graves' disease is suggested by Adamson and Cameron (49) and confirmed in part by Rabinowitch (50) wno find that vitamines A and D plus iodojecoleic acid is as effective as Lugol's solution in producing subjective improvement and lowering the basal metabolism, while if the vitamines and the iodised fatty acid are used separately no such effect is obtained. Himwich and co-workers (51) report increased appetite in hyperthyroidism produced experimentally in dogs as the result of feeding vitamine B, suggesting that the amount of vitamine B required is determined by the caloric needs. The experiments suggest possible improvement in dietary measures so essential in the care of patients ill with Graves' disease.

When ergotamine became available commercially many reports appeared in the literature advocating its use in the treatment of Graves' disease. For the first time a drug was at hand which would depress the sympathetic. The results have been disappointing and so far as the author is aware this drug has little place in our management of Graves' disease. Those interested may refer to the recent article by Youmans and Trimble (52) who have reviewed the literature.

Attempts to influence Graves' disease by the administration of antithyroglobulin sera have been unsuccessful. Schulhof (53) recently reports no influence on the basal oxygen consumption in rats when thyroglobulin and antithyroglobulin are injected simultaneously.

The most suggestive possibility of an addition to our medical equipment in the treatment of Graves' disease comes from Marine's laboratory. The effect of injury of the adrenal cortex on the thyroid gland immediately suggested the use of adrenal gland in the treatment of Graves' disease. In 1921 and 1924 Marine and Shapiro (54) reported 20 cases of Graves' disease treated with glycerol extract of fresh ox adrenal cortex. A striking improvement was observed within twelve to fifteen days. There was gain in weight and strength, a disappearance of diarrhœa, and definite fall in the basal metabolic rate, the latter approaching normal within two to four months. Recently Marine, Bauman and Webster (55) report that the same general results have been obtained by this method in 50 additional cases.

With the advent of Swingle's potent adrenal extract a few cases have been treated by Harrop, of Baltimore, and Rowntree, of Mayo's Clinic, with intravenous administration (56). Certain of the cases have responded with a marked drop in the basal and some improvement subjectively. Others, more in number, have shown no effect. The few cases the writer has observed have shown no significant benefit after the intravenous administration of the extract.

## Diabetes Mellitus

Since the introduction of insulin by Banting and its isolation in crystalline form by Abel and associates (57) nothing comparable has been contributed to the subject of diabetes. A vast amount of work has been reported on the physiology of insulin and carbohydrate metabolism which cannot be reviewed here. An excellent summary of the literature with a bibliography of 456 papers selected from a total of 3000 by Cori (58) has appeared within the past month. He briefly summarizes the discussion in his 100 page

article in the statement: "the increase in the rate of oxidation of blood sugar in the tissues and of conversion of blood sugar to muscle glycogen and inhibition of hepatic glycogenolysis seem to be well established effects of insulin." The problem of whether any or all of these effects are basic remains unsolved.

Several attempts have been made by Murlin (59) and others to overcome the difficulties and inconveniences of subcutaneous administration of insulin by giving it by mouth but without significant success. Insulin precipitated by phosphotungstate when administered by mouth has been shown by Mukherjee (60) to lower blood sugar and he believes it effective in the treatment of diabetes. Flasch (61) mixes insulin with saponin and finds the mixture effective by mouth although its action is delayed twelve hours. Recently Steinitz (62) reports a diminution of blood sugar and glycosuria experimentally by mouth administration of choloinsulin which is an addition compound of deoxycholic acid and insulin. Its use practically proved disappointing. The ease with which insulin is destroyed in the gastro-intestinal tract and variability in absorption are obstacles difficult to surmount in developing any method for using the hormone by mouth. Collip (63), Best and Scott (64) and Kaufmann (65) have isolated from yeast and various vegetables and plants an insulinlike substance known as "Glukonin" but no practical use for it has been discovered.

Many attempts to introduce insulin substitutes, products that may be taken orally have met with little success. One having the greatest vogue for a time perhaps was synthalin, a guanidine derivative proposed by Frank, Nothmann and Wagner (66). Bischoff, Sahyun and Long (67) made 25 different compounds of guanidine having hypoglycemic properties which are closely related to lethal doses and toxic effects. Numerous clinical reports have appeared at first favoring the use of guanidine derivatives but later giving them up because of the damaging effect on the liver and kidneys. The toxic effects are discussed by Karr, Belk and Petty (68). The blood sugar lowering effects obtained with

"Glukhoment," a pancreas autolysate proposed by von Noorden (69) has been shown to be due to guanidine action by Bischoff, Blatherwick and Sahyun (70) and Langecker (71). Galegine, isolated from Galega officinalis by Tanret (72) and studied by Müller (73); Myrtillin, extract of blueberry leaf proposed by Durig, of Vienna, because of its use for diabetes by the Alpine peasant, isolated by Wagner and associates (74) and championed clinically by Allen (75); extracts of Rhizomes (76) and liver extracts (77) have been proposed as insulin substitutes but have gained no ground clinically.

Perhaps the development most appreciated by both physician and patient is change in attitude toward the use of carbohydrate in cases requiring insulin. The influence of the period of low carbohydrate, high fat under-nutrition diets introduced by Allen persisted for several years after the appearance of insulin. As experience with the use of insulin increased it became apparent that certain individuals on a low carbohydrate high fat diet required amounts of insulin far beyond theoretical calculations. The first case (under Dr. Ladd's care) coming to the writer's attention eight years ago is a striking example. A 47 year old hotel clerk entered the Presbyterian Hospital July, 1923, with a history of diabetes of five years' duration. Previous to admission efforts to control the glycosuria had resulted in a loss of over 100 pounds for his diet had to be restricted to carbohydrate 60 grams, protein 80 grams, fat 100 grams in order to keep him sugar free. His weight was 40 kilograms on entrance to the hospital. The diet and insulin were increased until for nearly four months he was taking carbohydrate 110, protein 75, fat 250, 3270 calories, requiring 180 units of insulin which did not keep him entirely sugar free. On this regime he gained eight kilos but improved little in strength and sense of well being. For the succeeding four months he was given a diet of carbohydrate 140 grams, protein 70 grams, fat 160 grams, calories 2349, which required 150 units of insulin to keep him sugar free but during this period he lost 2.5 kilos. Following Dr. Geyelin's

suggestion a radically transposed diet of carbohydrate 250 grams, protein 75 grams, fat 100 grams, calories 2200 and 105 units of insulin resulted in regaining the lost 2 kilos within 6 weeks. On this diet he doubled his hospital entrance weight during the year following discharge, and was able to resume nearly normal activities. With this high carbohydrate low fat, slightly under maintenance diet and sufficient insulin to keep him sugar free he remained well until July 1926 when he died suddenly probably of a coronary occlusion. Since Geyelin's (78) observations several reports favoring the high carbohydrate low fat diet have appeared (79) (80) (81) (82) (83). Notwithstanding the success of Newburgh and Marsh (84) with high fat diets in the treatment of diabetes in the pre-insulin days there already existed evidence against this onesided diet in the work of DuBois and Geyelin (85) who found great difficulty in maintaining nitrogen equilibrium in diabetics taking a low carbohydrate high fat diet. This fact probably explains in part the gain in weight and strength of the patient taking a much lower caloric diet when the carbohydrate intake is 2½ times the fat.

Recently Dr. Geyelin (86) has assembled the results of treatment of some 200 cases of diabetes including children and adults. Some of his patients came under observation before the days of insulin and constitute excellent controls. On diets adjusted so that the carbohydrates in grams amount to 2½ to 3 times the fat with adequate protein for the age of the individual, normal growth occurs in children and in all the blood cholesterol can be maintained within normal limits. The blood sugar tends to be lower. The increase in carbohydrate, up to 20 grams, utilized per unit of insulin is quite remarkable when compared with 2 to 5 grams on the high fat low carbohydrate arrangement employed formerly. The calories can be fixed at any level deemed wise to keep the weight within desirable bounds. Since high blood cholesterol is considered to favor the development of arteriosclerosis this type of diet would seem to be of great importance in the treatment of diabetes. None of Geyelin's

children have developed arteriosclerotic changes. Furthermore, the diet should serve as a great protection during the stress and strain of acute infections. Such a diet certainly makes for palatability, keeps the patient happier and frequently saves expense in the reduced amount of insulin needed.

A word of warning concerning arteriosclerosis in diabetes comes from Joslin (87) who is so intimately associated with the disease. He reminds us that although our equipment for coping with the disease has improved, there is a striking increase of arteriosclerosis among diabetics. He furnishes interesting statistics. Deaths in diabetics due to arteriosclerosis during the Naunyn era were 15 per cent, the Allen era 26 per cent, the Banting era 41 per cent and among his own cases during the last four years 50 per cent. Truly an alarming increase! This mortality rate he claims is 1/3 greater than for the population in general. Naturally one factor influencing the incidence of death due to arteriosclerosis may be found in the reduction in death rate due to coma which was 61 per cent in the Naunyn era and only 11 per cent at the present time. There has been a reduction in the incidence of active tuberculosis among diabetics. Furthermore, the average length of life twenty-five years ago was 44 as compared with 60 now. Joslin believes cholesterol is an important factor in the development of arteriosclerosis. Certainly there is a tendency to high values in diabetes, values which can be influenced by a diet low in cholesterol. Therefore if you are a diabetic and Dr. Joslin be your doctor you may never have more than one egg a day!

Within the past few years several cases of tumors involving the pancreas associated with hyperinsulinism have been reported. Carr and associates (88) add the most recent case described in the April 25th issue of the *Journal of the American Medical Association* where may be found references to other cases. In several of the patients the tumor has been removed successfully with clinical cure, in others

the tumor was malignant. The clinical picture is in every way similar to the familiar insulin shock and relief secured by the administration of glucose.

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# PRINCIPLES GOVERNING CONTACT OF PHYSICIANS WITH THE PUBLIC THROUGH THE PRESS, LECTURE PLATFORM, LAY PERIODICALS AND THE RADIO.

## FOREWORD

In setting forth the Principles Governing Contact of Physicians with the Public through the Press, Lecture Platform, Lay Periodicals and the Radio, The New York Academy of Medicine and the Medical Society of the County of New York, through their Medical Information Bureau, have been guided by the belief that the members of the medical profession, and particularly members of these two organizations are prompted by the desire to act in accordance with medical traditions and that code of ethics which, in its last analysis, has been laid down for the benefit of the public rather than the profession.

Action in accordance with this general standard has become particularly complex and difficult during recent years in the matter of the approach to the public through various forms of publicity. The principles which have been adopted governing this relationship are presented more to aid our memberships in knowing the course to be followed in any given case, rather than with the intention of making fixed rules to which strict adherence must be demanded. It is our desire to be helpful and co-operative rather than disciplinary. In this spirit we ask the co-operation of our associates in the hope that the principles herein set forth will be an aid to them and that, with this aid, occasion for taking cognizance of unethical publicity will not arise.

CHARLES GORDON HEYD,
President, Medical Society of the County of New York

JOHN A. HARTWELL,
President, The New York Academy of Medicine

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*Approved by Council of The New York Academy of Medicine, May 27, 1931.*

*Approved by Comitia Minora, Medical Society of the County of New York, Oct., 9, 1931.*

The present tendencies in social and economic life have made it desirable that the medical profession, both as an aggregate body and through its individual members, should become more articulate in its relation to the public.

However, this being something of a departure, it is necessary that a working set of principles be formulated to guide physicians in their public contact with the community, to the end that the best interests of the community be served and that ethics be not violated.

In considering the common avenues through which the profession and individual physicians may address the public, namely the press, the radio, the public platform and popular publications, we find three possible types of approach. These are publicity, propaganda, and public health education.

*Publicity*

Publicity we witness in the medical world under two aspects. In one it gives due public notice of events which constitute legitimate news, such for example as the election of new officers in a medical organization; the opening of a new hospital; the award of a prize for distinction in medicine and the like. Such publicity is legitimate and desirable, and the use of a physician's name in this connection is not reprehensible.

There is, however, another form of publicity unfortunately employed by a small section of the medical world, which has for its aim the exploitation or advertisement of an individual through mention of his name in the public press.

In such publicity, the comings and goings of the individual are featured, his connections, achievements and honors are mentioned and he is thereby deliberately and often without any warrant given undue prominence in the public eye. This form of publicity is objectionable, because its aim is reprehensible and the effect upon the public and

upon the profession will be deleterious. This type of publicity among physicians cannot be countenanced.

*Propaganda*

Propaganda has for its main objectives the arousing of public interest in supporting and acting on health matters.

In propaganda, emphasis is placed on some matter of public health interest and only incidentally upon the physicians connected with it. Tuberculosis prevention, cancer control, diphtheria prevention are legitimate public health items for propaganda. The appearance of physicians' names in connection with such agitations is by the exigencies of press practices necessary and allowable.

*Public Health Education*

Public Health Education differs from publicity and propaganda by the nature of its content. A statement, for example, that measles is a much neglected and dangerous disease made by Dr. Jones may serve as a typical example of a public health education message. Such a statement should not give special prominence to its maker. On the other hand, the statement is given impressiveness and authoritativeness when emanating from a representative physician or from an official medical body. Such a physician speaks not for himself but for the profession. He serves merely as the mouth piece through which is expressed a fact universally agreed upon by physicians.

*Radio Broadcasting*

The radio presents a number of singular problems which need individual consideration. It is highly desirable that the medical profession should take advantage of the opportunities for constructive propaganda and for health education presented by the radio. And yet the radio is a medium in which the personality of the speaker, understood in its widest implications, counts for much. Anonymity on the radio is, therefore, incongruous. A physician making an address on the radio must of necessity be introduced by name. More than that, to establish his right to

speak his standing or connections, educational or associational, must be given.

All of these requirements can be fulfilled without violence to good taste or ethical procedure. The speaker's name may be given by the announcer without adorning and superlative references to his abilities or achievements. "Dr. John Jones, Clinical Professor of Medicine at the X. Y. Z. University" will suffice as an introduction. Dr. John Jones, who is a practicing physician, should not be introduced as an internationally famous authority, etc.

In the body of the radio paper, references to the person of the speaker, his singular achievements, unique and outstanding practices, should be kept down to an absolute minimum. In theory, the physician speaking on the radio is the vocal representative of the medical profession addressing the public. He brings to the public the fruits of many men's labors. In this, he is the custodian and administrator of the wealth accumulated by the scientific endeavors of the profession. His personal interests, and individual convictions must be placed secondary to the interests and dominant convictions of the profession. There are proper channels provided for the advancement of a physician's medical ideas.

It is desirable that talks over the radio by physicians should be given under the auspices of the designated committees of the New York Academy of Medicine and of the Medical Society of the County of New York.

Commercial organizations may purchase time "on the air" with increasing frequency in order to procure good will, and use it for broadcasting public health information. Frequently, physicians are employed to compose and deliver such broadcasts.

Provided that the commercial organization is of reputable standing, there is no objection to physicians accepting such employment. A physician must not, however, make his address an endorsement or testimonial for the

product or products of the organization on whose time the broadcast is given.

In order to safeguard himself and the profession, when such employment is offered him, a physician should confer with the Medical Information Bureau, both as to the standing of the commercial organization with which he is to make a connection and the contents of the paper or papers he proposes to broadcast.

It is also important that the announcer's continuity should be acceptable. No exaggerated or unwarranted claims should be allowed, nor should the announcer be permitted to imply that the speaker endorses the commercial organization or its products.

*Magazines and Periodicals*

Articles written by physicians for magazines on medical topics affecting the profession should be subject to prepublication review by the local medical organization.

*Summary*

The full intent of these considerations is to facilitate and in no way to hamper educational contact of the profession with the public. They are designed to encourage the expression of the views of the profession to the public. They provide against objectionable publicity by self-seeking individuals whose only design is to aggrandize their persons beyond all merit.

They are formulated for the protection of the public, and for the advancement of the basic interest of the profession by whose progress or regression we all are fundamentally affected.

# SCIENCE AND CULTISM*

*An Editorial Reprinted from The Journal of The American Medical Association*
Feb. 1, 1930, Vol. 94, pp. 342 and 343.

Now and then the medical profession is upbraided by the proponents of various notions in the field of health and science because it fails to give to their claims what they conceive to be adequate consideration. Again and again, the difficulties of Galileo, Harvey, Jenner and Pasteur, when they attempted to convince the leaders of their times of the importance of their discoveries, are cited as evidence that scientists are intolerant. Apparently cultists and others who have had but little experience in reasoning and logic, or with what is known as the scientific method, fail to take into account the fact that the world has moved since the time of the prophets, and that science has advanced more in the past fifty years than in the previous fifty centuries. James Harvey Robinson wrote an interesting essay on "The Importance of Being Historically Minded." With a proper perspective, one realizes that science is today in a position to demand evidence to an extent that might not have been warranted in a previous period when the whole world was dominated by magic and mysticism.

Recently, Mr. Chester Rowell, feature writer for the San Francisco *Chronicle,* discussed the appeal for tolerance made by faith-healing cults in the Los Angeles *Times,* following an exposé by the editor of *The Journal* of some of the weird quackeries existing in Los Angeles. Mr. Rowell says:

> But the appeal for "tolerance," by one "school" of another, is an example of a common fallacy. There is no "tolerance" of astrology by astronomers. There is no "tolerance" of fortune-telling by psychologists, nor of perpetual motion inventors by physicists. Geologists do not locate oil or water by

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dowsing with a forked stick, nor "tolerate" those who do. Entomologists do not "tolerate" those who would exterminate insect pests by interfering with their spontaneous generation. Scientific agriculture does not "tolerate" the theory that potatoes grow wrong unless planted in the dark of the moon. All these "schools" exist, and they are all rejected outright as unscientific superstitions by every scientist in the world.

On the other hand, good Catholics tolerate the Holy Rollers, and Buddhists tolerate the Mormons. Atheists tolerate the faith of Christians and Christians the unfaith of atheists. Protestants and Christian scientists tolerate each other's religion, each respecting the right of the other to seek God in his own way. But the law of the land did not tolerate polygamy, when the Mormons said it was religion, and the Regents of the University of California do not permit an antivaccinationist student to endanger the health of other students, even though he calls his objection religious.

So in medicine. If it were a matter of faith, dogma or canons, one "school" should "tolerate" another. If it is a matter of science, then the only distinction is that of scientific and unscientific. And between science and non-science there is no equality of right, and no basis for tolerance. The fact that millions of devout people in India believe in casting their horoscopes by the stars does not erect them into a "school" of astronomy, nor impose on astronomy any obligation to recognize them. They are neither "regular" nor "irregular" astronomers—they are not astronomers at all. Neither is any unscientific theory or practice of healing any part of the science of medicine. There are only two sorts of medicine, scientific and unscientific. And of the unscientific "schools," science has only this to say —that they are unscientific.

How, then, shall we distinguish which principles and practices of healing are scientific, and which are not? The simplest test is that which we unhesitatingly apply in every other branch of knowledge. That is the judgment of scientists. If the scientists say that a certain thing is scientific, we accept it as such. If they all say it is unscientific, we say likewise, at least until it has succeeded in convincing them. Every scientific university in the world teaches astronomy, and not one teaches astrology. All of them teach chemistry and not one teaches alchemy. Every university in the world teaches scientific medicine, and not one of them—not a single one in the whole world—teaches or recognizes any of the "schools" or sects for which the *Times* speaks. If the unanimous voice of science means anything, this is its verdict.

The next test, and the decisive one, is that of method. Scientists may be mistaken, sometimes, in their results and conclusions. Sometimes a thing which seems true in the light of incomplete information becomes only partly true in the light of later discoveries. But science is not mistaken in its method. That method is systematic observation and experiment, and the submission of these observations and experiments to the scientists of the world, for them to repeat, to test and to scrutinize. Whatever pursues that

method and is approved by the test is scientific—including, in medicine, light rays for tuberculosis, diet for many ailments and hydrotherapy for certain mental conditions. Whatever does not proceed by that method, or fails by that test, is unscientific—including all the cults, sects and schools which Dr. Fishbein rejects and the *Times* defends.

Mr. Rowell has placed his finger unerringly on the weaknesses of the cultists. His logic might well serve as a text in the schools, not only that it might aid the younger generation in learning the art of reasoning and judgment, but also that physicians might realize the basic folly of the strange schemes which are constantly being introduced to the public around them.

## INTERNATIONAL HOSPITAL ASSOCIATION

At the close of the Second International Hospital Congress which met in Vienna from June 8 to 14, the representatives of the 41 countries participating in the Congress voted unanimously to organize an International Hospital Association.

The purpose of the Association is to bring about an international exchange of opinion and international cooperation in all problems and in all fields of hospital work and in all relationships, economic, sociological and hygienic. The Association is composed of two classes of members: ordinary members consisting of national hospital associations and associate members.

The latter comprise individuals associated in one way or another with hospitals or cognate institutions and representatives of firms or organizations standing in a business relationship to the hospitals, such as architects, builders, manufacturers of hospital supplies, merchants and the like.

The associate membership in the International Hospital Association entitles the members not only to free subscription to the "Nosokomeion," the official organ of the Association, and to full participation in the International Hospital Congresses, but above all, to participation in the work of the 10 permanent committees. These committees under the leadership of recognized specialists in various fields will devote their time to working out standards for the guidance of the hospital field throughout the world.

Dr. René Sand is president of the Association and Dr. E. H. Lewinski Corwin is secretary-general and treasurer.

## RECENT ACCESSIONS TO THE LIBRARY

Allen, F. M. B. Handbook of diseases of infants and children.
N. Y., Wood, 1930, 595 p.

Allison, N. and Ghormley, R. K. Diagnosis in joint disease.
N. Y., Wood, 1931, 196 p.

Association for research in nervous and mental disease. Epilepsy and the convulsive state. Pt. I.
Balt., Williams, 1931, 701 p.

Association for research in nervous and mental disease. Schizophrenia (dementia praecox).
Balt., Williams, 1931, 246 p.

Aucoin, E. L. L'endoscopie perorale.
Paris, Vigot, 1930, 255 p.

Barbara, G. Les réactions de Wassermann "irréductibles".
Paris, Doin, 1931, 118 p.

Bastard, J. Un malade de talent, Henri Heine.
Lyon, Bosc, 1930, 83 p.

Biology in human affairs. Edited by E. M. East.
N. Y., McGraw-Hill, 1931, 399 p.

Blos, E. Die Medizin am Scheidewege.
Karlsruhe, Kairos, 1931, 150 p.

Blum, L. and van Caulaert, C. Le rôle du sel dans les néphrites.
Paris, Masson, 1931, 292 p.

Bodansky, M. and Fay, M. S. Laboratory manual of physiological chemistry. 2. ed.
N. Y., Wiley, 1931, 260 p.

Bogert, L. J. Nutrition and physical fitness.
Phil., Saunders, 1931, 554 p.

Bonnecase, J. Le droit disciplinaire dans la profession médicale.
Paris, Sirey, 1930, 472 p.

Coca, A. F.; Walzer, M. and Thommen, A. S. A. Asthma and hay fever in theory and practice.
Springfield, Ill., Thomas, 1931, 851 p.

Craciun, E. C. La culture des tissus en biologie expérimentale.
Paris, Masson, 1931, 440 p.

Crichton-Browne, (Sir) J. The doctor's second thoughts.
London, Benn, [1931], 294 p.

Dobson, M. B. Dynamic retinoscopy.
London, Milford, 1931, 55 p.

von Economo, C. Encephalitis lethargica; its sequelae and treatment.
London, Milford, 1931, 200 p.

Essig, E. O. A history of entomology.
N. Y., Macmillan, 1931, 1029 p.

Fahrenkamp, K. Der Herzkranke.
Stuttgart, Hippokrates-Verlag, 1931, 287 p.

Fischer, H. Johann Jakob Wepfer.
Zürich, Rudolf, 1931, 109 p.

Franck, R. Moderne Ernährungstherapie für die Praxis des Arztes.
Berlin, Vogel, 1931, 184 p.

Gauss, H. and Gauss, E. V. Clinical dietetics.
St. Louis, Mosby, 1931, 490 p.

Glasser, O. Wilhelm Conrad Röntgen und die Geschichte der Röntgenstrahlen.
Berlin, Springer, 1931, 337 p.

Goadby, (Sir) K. Diseases of the gums and oral mucous membrane. 4. ed.
London, Milford, 1931, 496 p.

Gottlieb, B. and Orban, B. Die Veränderungen der Gewebe bei übermassiger Beanspruchung der Zähne.
Leipzig, Thieme, 1931, 225 p.

Harrison, L. W. The diagnosis and treatment of venereal diseases in general practice. 4. ed.
London, Milford, 1931, 567 p.

Hawk, P. B. and Bergeim, O. Practical physiological chemistry. 10. ed.
Phil., Blakiston, [1931], 929 p.

Heinrich, H. W. Industrial accident prevention.
N. Y., McGraw-Hill, 1931, 366 p.

Henry, R. and Busson, G. Manuel d'urétroscopie postérieure.
Paris, Masson, 1931, 80 p.

Hill, A. V. Adventures in biophysics.
Phil., Univ. of Penn. Pr., 1931, 162 p.

Hilliard, C. M. The prevention of disease in the community.
N. Y., McGraw-Hill, 1931, 193 p.

Janet, P. M. F. L'automatisme psychologique. 10. éd.
Paris, Alcan, 1930, 496 p.

Janet, P. M. F. L'état mental des hystériques. 3. éd.
Paris, Alcan, 1931, 168 p.

Jordan, E. O. A text-book of general bacteriology. 10. ed.
Phil., Saunders, 1931, 819 p.

Keyser, C. J. Humanism and science.
N. Y., Columbia Univ. Pr., 1931, 243 p.

Koch, E. Die reflektorische Selbststeuerung des Kreislaufes.
Dresden, Steinkopff, 1931, 234 p.

Korschelt, E. Regeneration und Transplantation.
Berlin, Borntraeger, 1931, v. 2. pt. 1.

Kraus, R. Scharlach; Aetiologie, antitoxische Serumtherapie und Schutzimpfung.
Berlin, Urban, 1931, 365 p.

de Lavergne, V. Allergie et anergie en clinique.
Paris, Doin, 1931, 312 p.

Lees, D. Practical methods in the diagnosis and treatment of venereal diseases. 2. ed.
N. Y., Wood, 1931, 634 p.

Lehrbuch der inneren Medizin von G. v. Bergmann, F. Stroebe, R. Doerr [et al.]
Berlin, Springer, 1931. 2. v.

Lemoine, P. and Valois, G. Éléments de biomicroscopie oculaire.
Paris, Masson, 1931, 302 p.

Leray, J. Embonpoint et obésité.
Paris, Masson, 1931, 195 p.

Lindworsky, J. Experimental psychology.
N. Y., Macmillan, 1931, 406 p.

Lovett, R. W. Lateral curvature of the spine and round shoulders. 5. ed.
Phil., Blakiston, [1931], 240 p.

Luckiesh, M. and Moss, F. K. Seeing; a partnership of lighting and vision.
Balt., Williams, 1931, 241 p.

McCoy, J. D. Applied orthodontia. 3. ed.
Phil., Lea, 1931, 344 p.

Meyer, J. and Saidman, J. Précis de physiothérapie et de petite chirurgie dermatologiques.
Paris, Doin, 1931, 200 p.

Münch, J. Klinik der konservierenden Zahnheilkunde.
Leipzig, Thieme, 1931, 217 p.

Pelouze, P. S. Gonorrhea in the male and female. 2. ed.
Phil., Saunders, 1931, 440 p.

Pruitt, M. C. Modern proctology.
St. Louis, Mosby, 1931, 404 p.

Reid, E. G. The great physician; a short life of Sir William Osler.
N. Y., Oxford Univ. Pr., 1931, 299 p.

Rockwell, G. E. Streptococcic blood stream infections.
N. Y., Macmillan, 1931, 73 p.

Rousset, J. Les dyskératinisations épithéliomateuses.
Paris, Masson, 1931, 599 p.

Russell, G. O. Speech and voice.
N. Y., Macmillan, 1931, 250 p.

Sachs, E. The diagnosis and treatment of brain tumors.
St. Louis, Mosby, 1931, 396 p.

Sadler, W. S. and Sadler, (Mrs.) L. (Kellogg). Piloting modern youth.
N. Y., Funk, 1931, 370 p.

Seelig, M. G. Medicine, an historical outline. [2. ed.].
Balt., Williams, 1931, 205 p.

Shaw, J. C. M. The teeth, the bony palate and the mandible in Bantu races of South Africa.
London, Bale, 1931, 134 p.

Simkins, C. S. Textbook of human embryology.
Phil., Davis, 1931, 469 p.

Siwek, P. La psychophysique humaine d'après Aristote.
Paris, Alcan, 1930, 210 p.

Spira, J. J. The causation of chronic gastro-duodenal ulcers; a new theory.
London, Milford, 1931, 78 p.

Stevens, A. A. The practice of medicine. 3. ed.
Phil., Saunders, 1931, 1150 p.

Veau, V. Division palatine; anatomie, chirurgie, phonétique.
Paris, Masson, 1931, 568 p.

Wenckebach, K. F. Herz- und Kreislaufinsuffizienz.
Dresden, Steinkopff, 1931, 120 p.

White House conference on child health and protection. White House conference, 1930. Addresses, and abstracts of committee reports.
N. Y., Century, [1931], 365 p.

White House conference on child health and protection. Sect. II. Public health service and administration. Committee on communicable disease control. Communicable disease control. Report.
N. Y., Century, [1931], 234 p.

Williams, J. F. Personal hygiene applied. 4. ed.
Phil., Saunders, 1931, 520 p.

Wirth, D. Grundlagen einer klinischen Hämatologie der Haustiere.
Berlin, Urban, 1931, 311 p.

Wright, S. Applied physiology. 4. ed.
London, Milford, 1931, 552 p.

Zinsser, H. Resistance to infectious diseases. 4. ed.
N. Y., Macmillan, 1931, 651 p.

## DEATHS OF FELLOWS OF THE ACADEMY

GEORGE THOMSON ELLIOT, M.D., Otisfield, Maine; graduated in medicine from the University of Louisiana, Baton Rouge, Louisiana, in 1881; elected a Fellow of the Academy February 2, 1899; died, September 14, 1931. Dr. Elliot was Professor of Dermatology at the New York Post-Graduate Medical School from 1896 to 1898 and at Cornell University Medical School for the next twenty-two years. He was Assistant Visiting Physician and Pathologist to the New York Skin and Cancer Hospital from 1884 to 1904 and dermatologist to the Demilt Dispensary for ten years.

ARTHUR LYMAN FISK, M.D., 145 East 54 Street, New York City; graduated in medicine from the Harvard Medical School, Cambridge, Massachusetts, in 1889; elected a Fellow of the Academy March 2, 1893; died, October 8, 1931. Dr. Fisk was a member of the Surgical Society of New York and was at one time connected with Post-Graduate, General Memorial and Trinity hospitals.

THEODORE HARVEY KELLOGG, M.D., Riverdale Lane, New York City; graduated in medicine from Bellevue Hospital Medical College, New York City, in 1865; elected a Fellow of the Academy April 3, 1879; died, September 20, 1931. Dr. Kellogg was a Fellow of the American Medical Association, a member of the County and State Medical Societies, a member of the Neurological Society and a member of the American Psychiatric Society.

WILLIAM LELAND STOWELL, M.D., Bronxville, N. Y.; graduated in medicine from New York University, New York City, in 1881; elected a Fellow of the Academy January 2, 1890; died, September 30, 1931. Dr. Stowell was elected a member of the Committee on Admission of the Academy December, 1914 for three years, and was Assistant Secretary of the Academy from 1918 to 1921. He was a member of the Alumni Association of City Hospital and associated with many other professional organizations.

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## OFFICERS OF SECTIONS, 1931-32

### DERMATOLOGY AND SYPHILOLOGY, 1st Tuesday

| *Chairman* | *Secretary* |
|---|---|
| Joseph J. Eller | Leo Spiegel |
| 100 West 59 Street | 241 West 100 Street |

### SURGERY, 1st Friday

| | |
|---|---|
| Robert H. Kennedy | William Barclay Parsons, Jr. |
| 115 East 61 Street | 180 Ft. Washington Avenue |

### NEUROLOGY AND PSYCHIATRY, 2nd Tuesday

| | |
|---|---|
| Joseph H. Globus | Byron Stookey |
| 1185 Park Avenue | 151 East 83 Street |

### HISTORICAL AND CULTURAL MEDICINE,
2nd Wednesday of November, January, March and May

| | |
|---|---|
| C. N. B. Camac | Howard Reid Craig |
| 76 East 56 Street | 125 East 74 Street |

### PEDIATRICS, 2nd Thursday

| | |
|---|---|
| Herbert B. Wilcox | John Caffey |
| 39 East 75 Street | Bard Hall, Haven Avenue |

### OPHTHALMOLOGY, 3rd Monday

| | |
|---|---|
| Mark J. Schoenberg | Algernon B. Reese |
| 1160 Park Avenue | 73 East 71 Street |

### MEDICINE, 3rd Tuesday

| | |
|---|---|
| Harold E. B. Pardee | Robert F. Loeb |
| 160 East 64 Street | 620 West 168 Street |

### GENITO-URINARY SURGERY, 3rd Wednesday

| | |
|---|---|
| Meredith F. Campbell | George F. Hoch |
| 140 East 54 Street | 115 East 61 Street |

### ORTHOPEDIC SURGERY, 3rd Friday

| | |
|---|---|
| Isadore Zadek | Mather Cleveland |
| 1095 Park Avenue | 115 East 61 Street |

### OBSTETRICS AND GYNECOLOGY, 4th Tuesday

| | |
|---|---|
| Gerard L. Moench | Frank Sovak |
| 30 East 58 Street | 117 East 72 Street |

### OTO-LARYNGOLOGY
(Officers appointed pro tem)

| | |
|---|---|
| John B. Rae | Richard T. Atkins |
| 260 West End Avenue | 4 West 53 Street |